Ref N. 10/691,480

(12) UK Patent Application (19) GB (11) 2 343 611 (13) A

(43) Date of A Publication 17.05.2000

(21) Application No 9817215.8

(22) Date of Filing 08.08.1998

(51) INT CL[7]
A22C 29/02 , A23L 1/33

(52) UK CL (Edition R)
A2U U1C

(56) Documents Cited
US 4336274 A

(58) Field of Search
UK CL (Edition P) A2B BMM39 , A2U U1C U1S
INT CL[6] A22C 29/00 29/02 , A23L 1/33 1/333
Online:WPI

(71) Applicant(s)
Lett Research And Development Limited
(Incorporated in Ireland)
Batt Street, County Wexford, United Kingdom

(72) Inventor(s)
Richard Lett
James Lett
Desmond Lett
Aodh O'Domhnaill

(74) Agent and/or Address for Service
Urquhart-Dykes & Lord
Alexandra House, 1 Alexandra Road, SWANSEA,
SA1 5ED, United Kingdom

(54) Abstract Title
Crab processing

(57) Live crabs are placed in a tank containing deoxygenated fresh water and citric acid. The crabs are then placed in containers having perforated side walls in layers and conveyed into a cooking unit containing heated brine and citric acid solution. The solution is agitated ensuring circulation around the crabs. The crabs are then cooled in a solution of chilled brine and citric acid. The cooked and cooled crab is then cleaned and washed and inedible crab meat is removed. The crabs are then graded, packed, pasteurised and stored.

GB 2 343 611 A

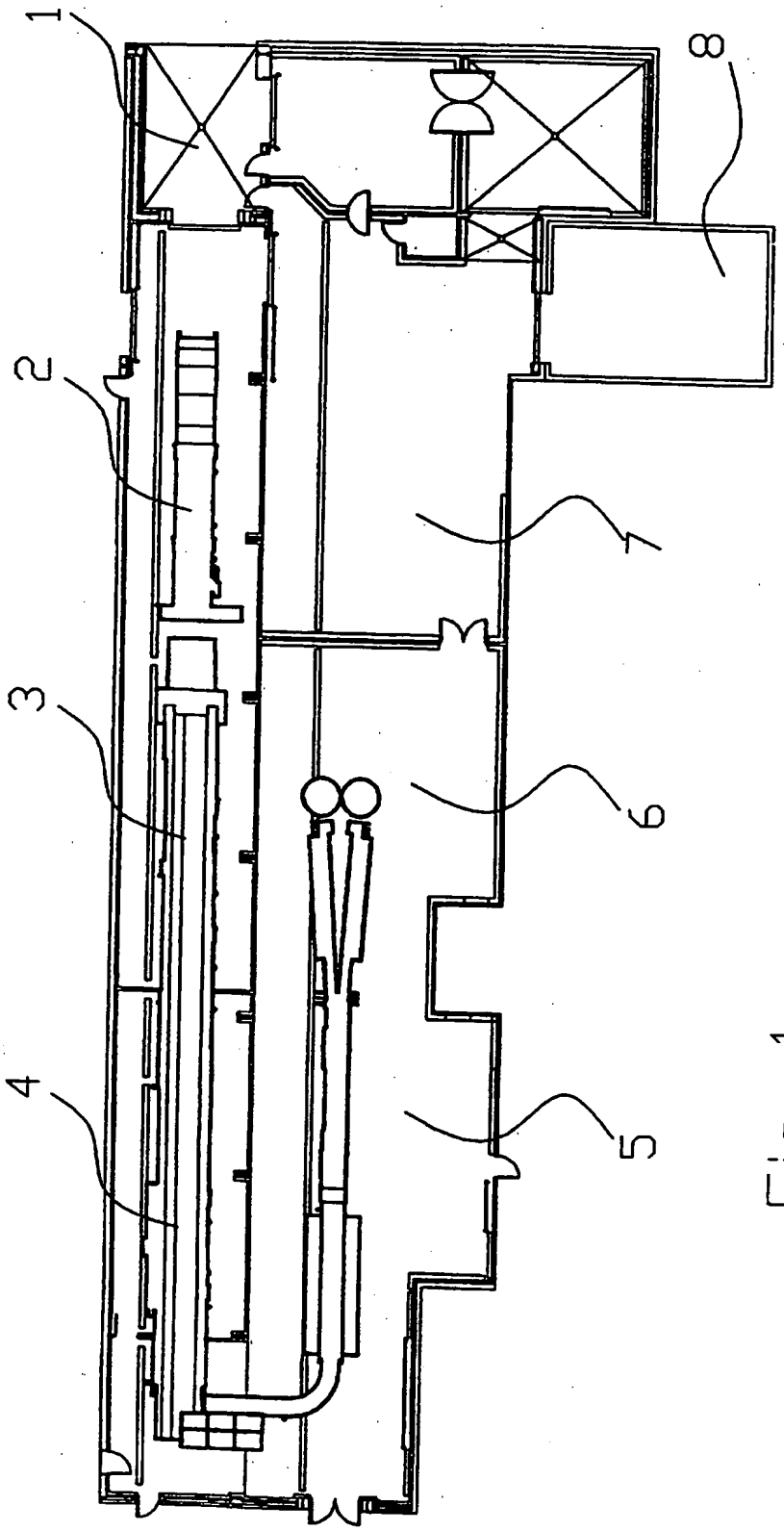

Fig. 1

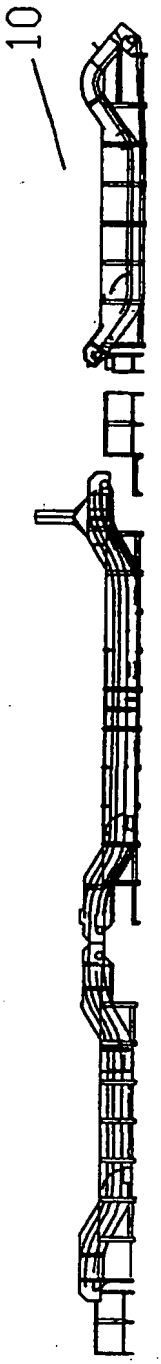

Fig. 4

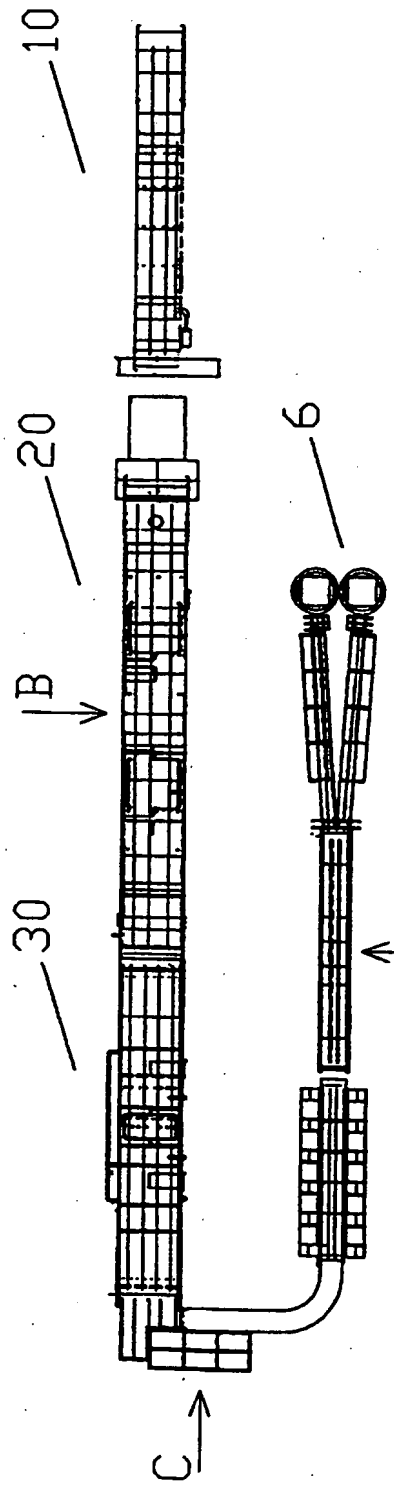

Fig. 2

Fig. 3

Fig. 5

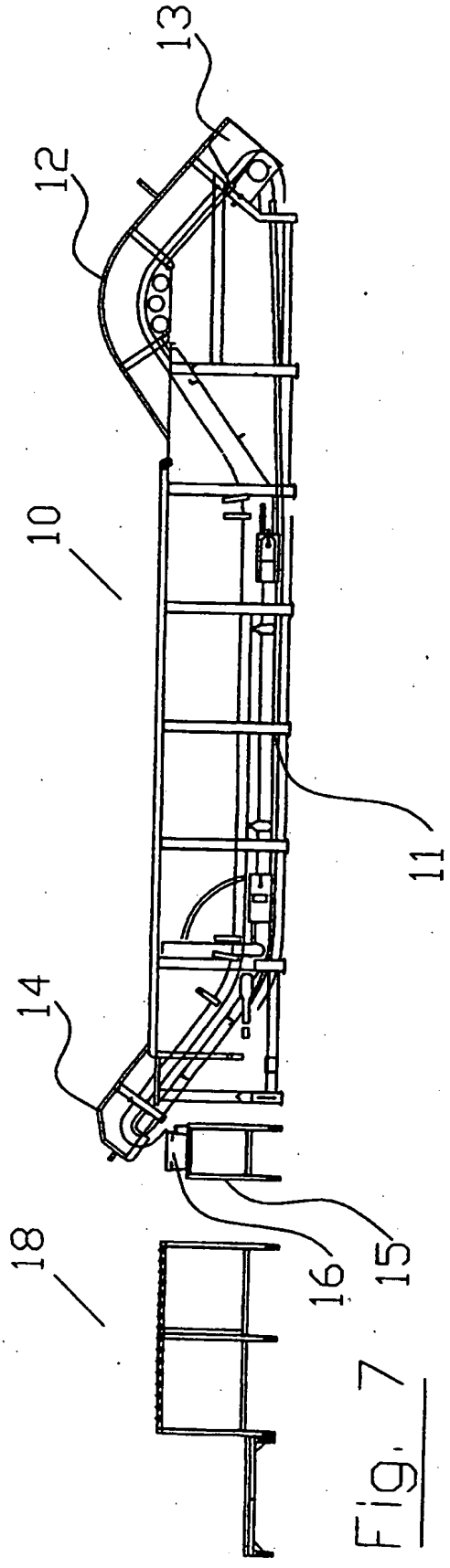

Fig. 7

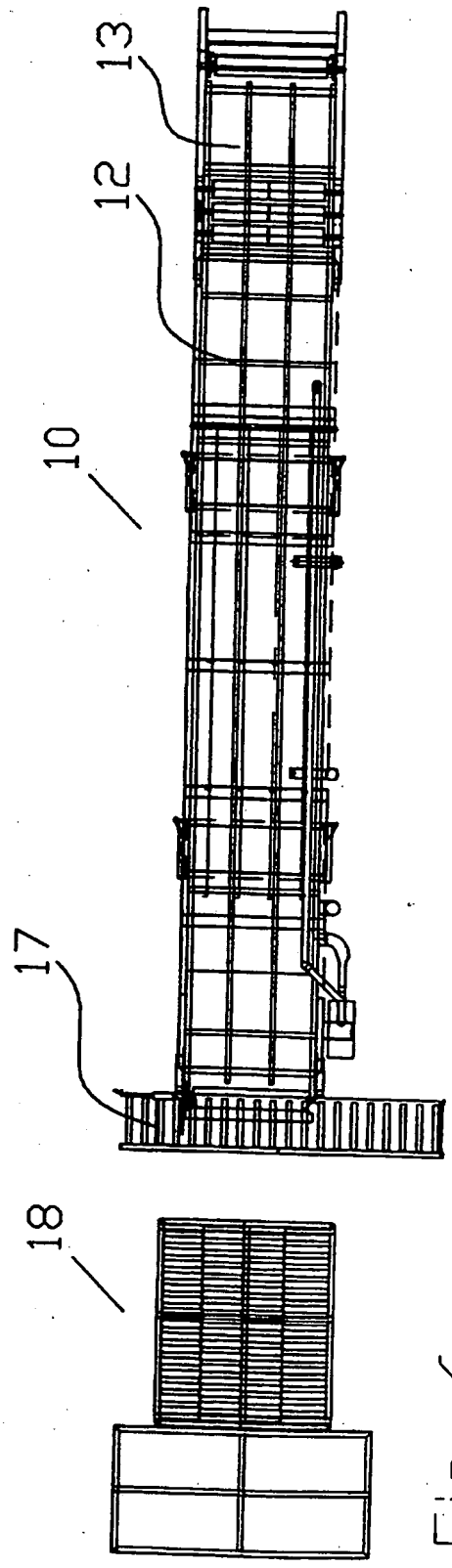

Fig. 6

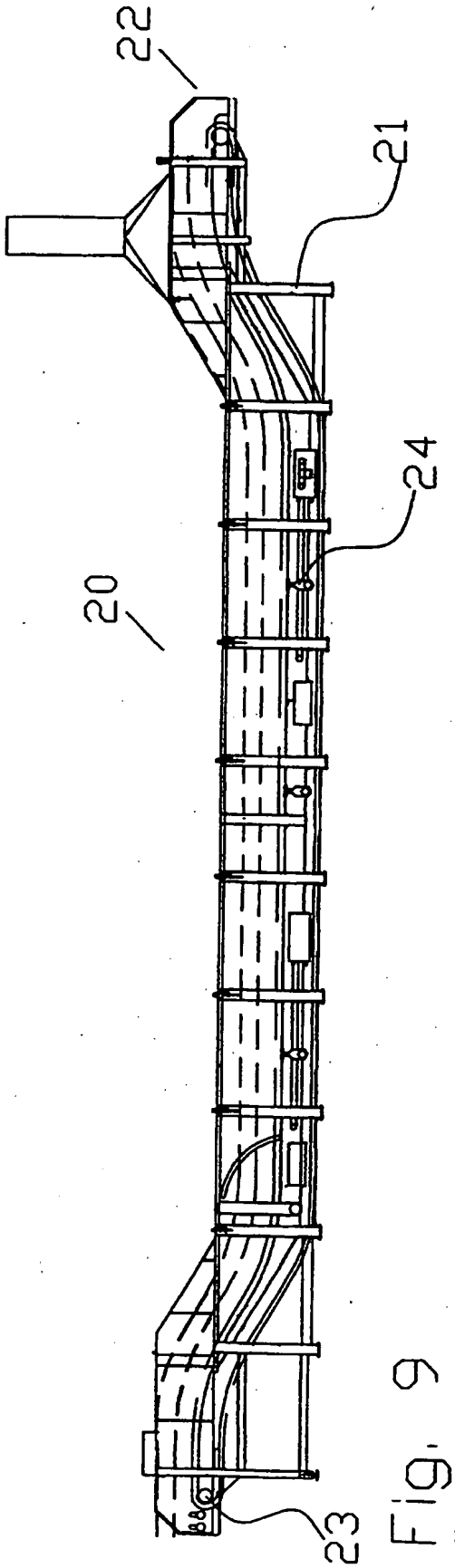

Fig. 9

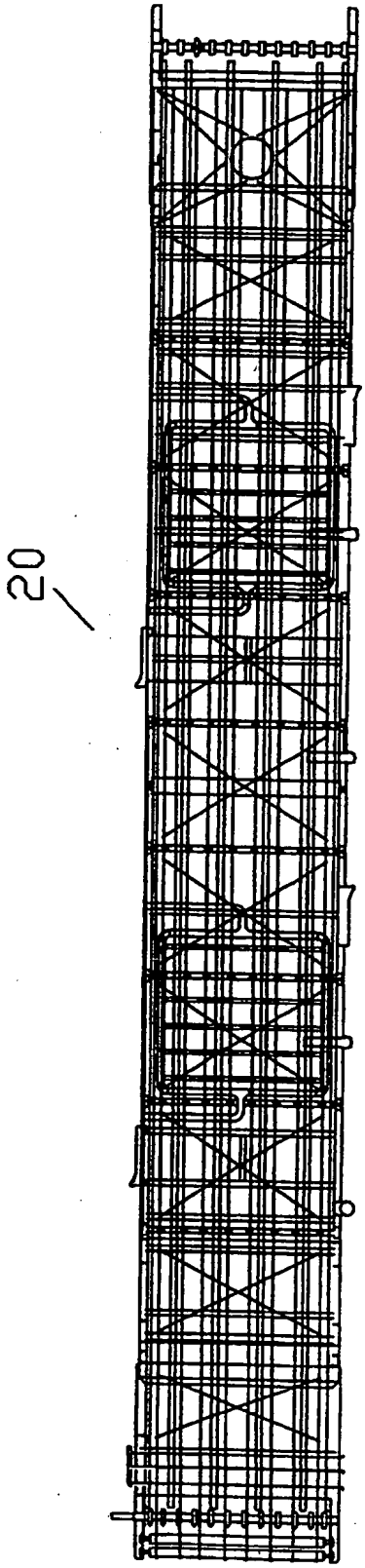

Fig. 8

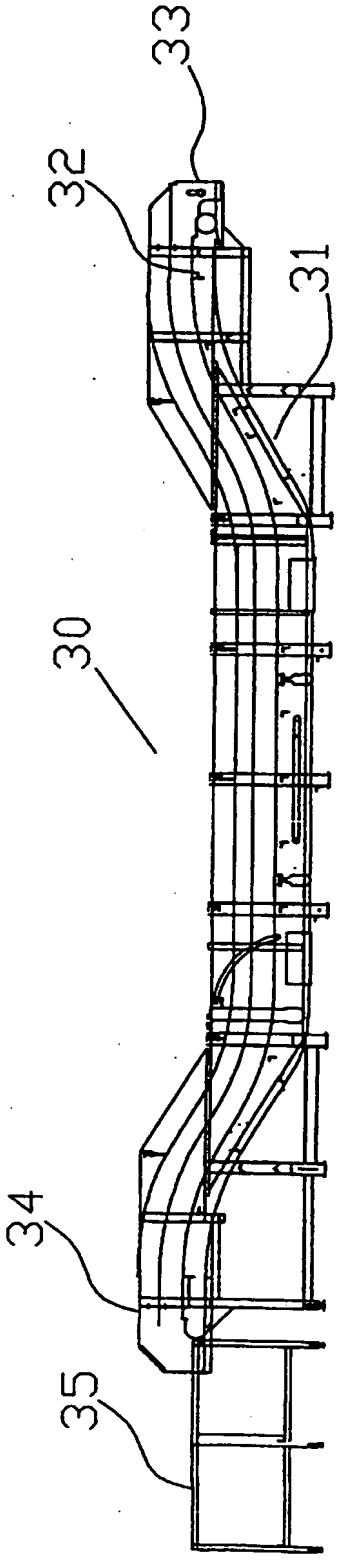

Fig. 11

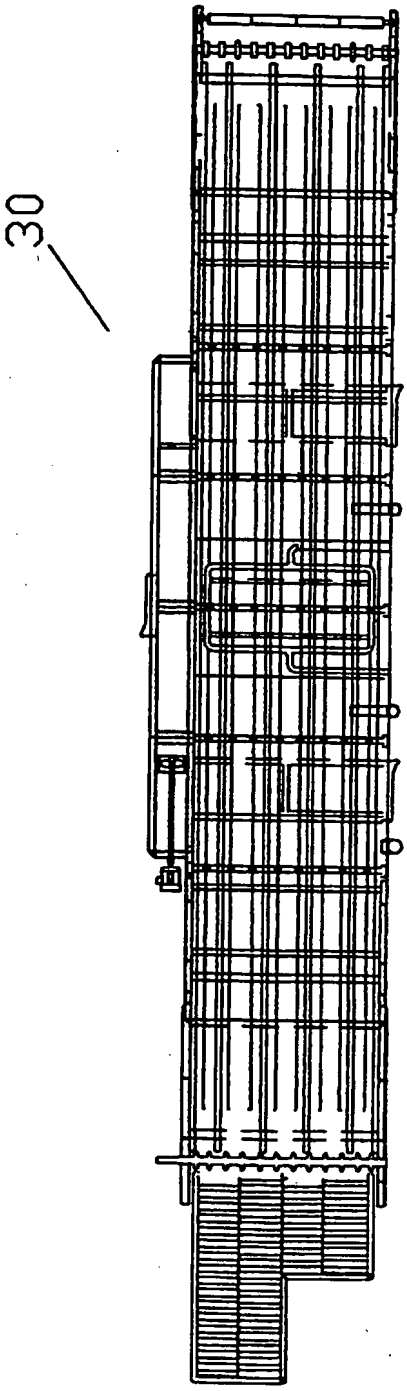

Fig. 10

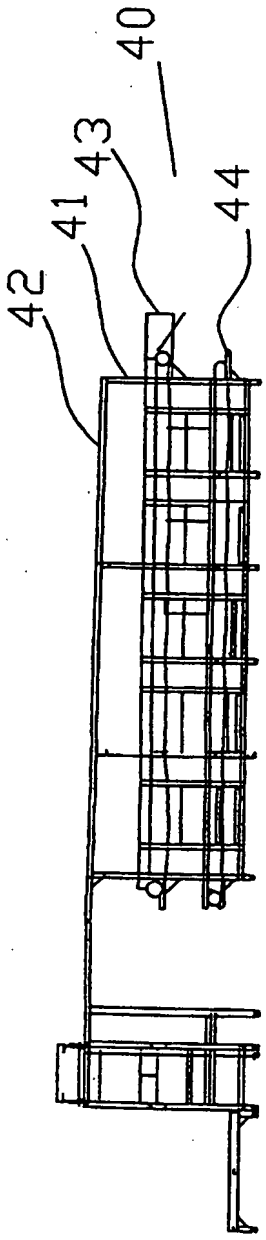

Fig. 13

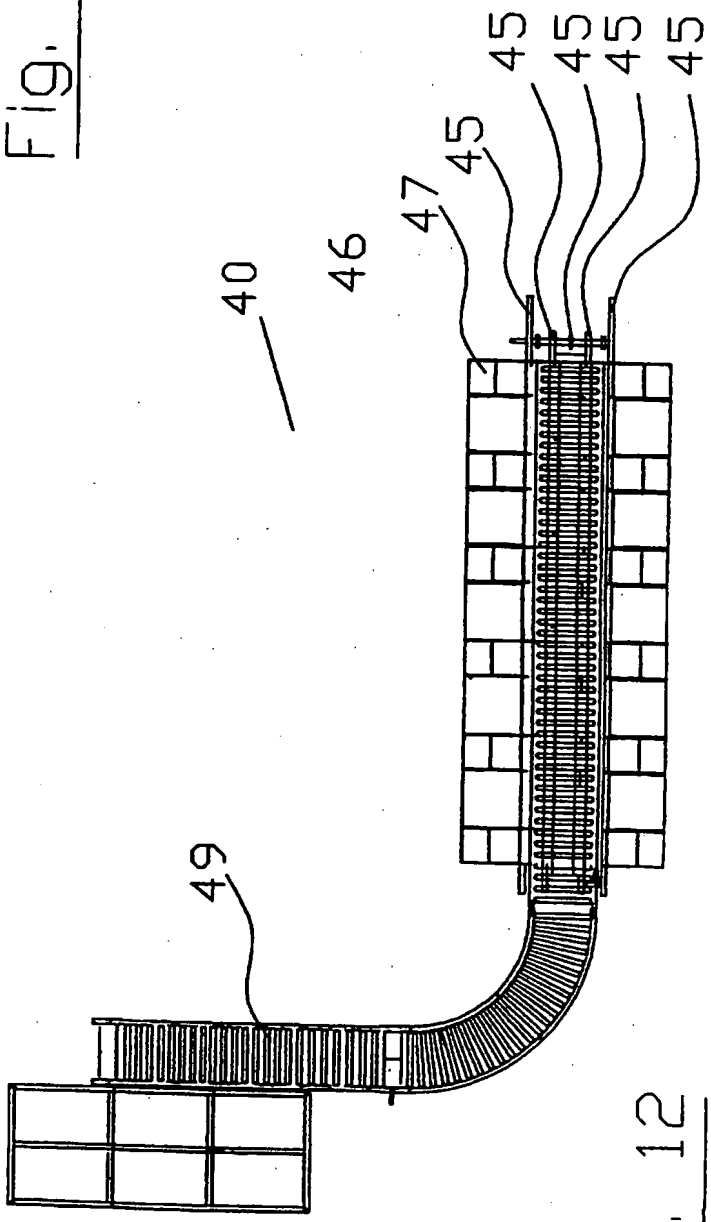

Fig. 12

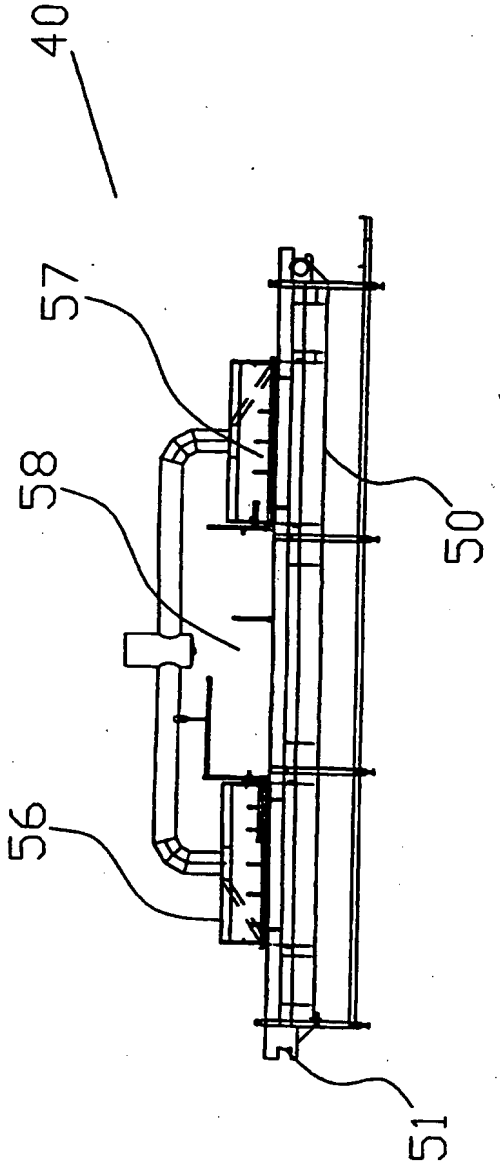

Fig. 15

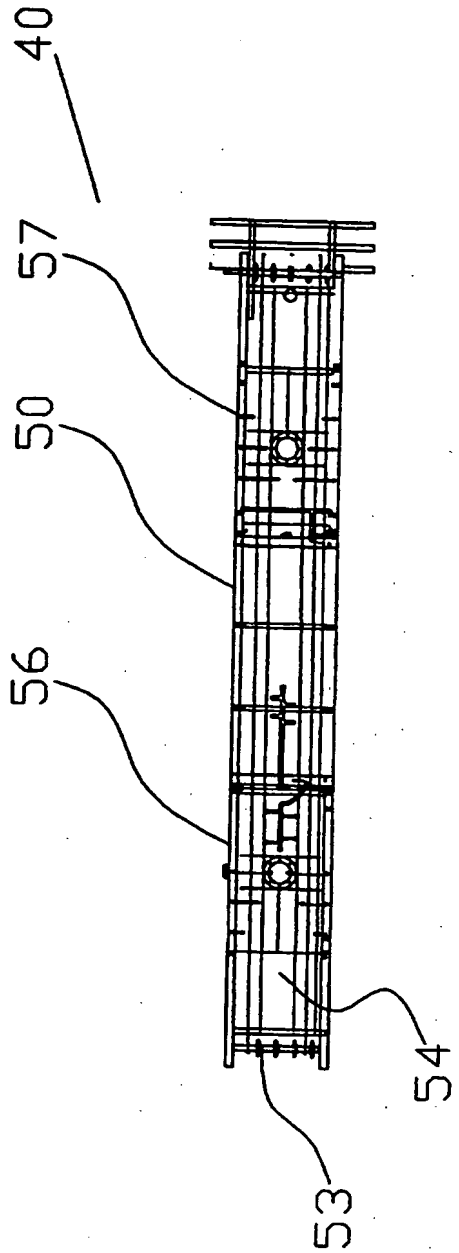

Fig. 14

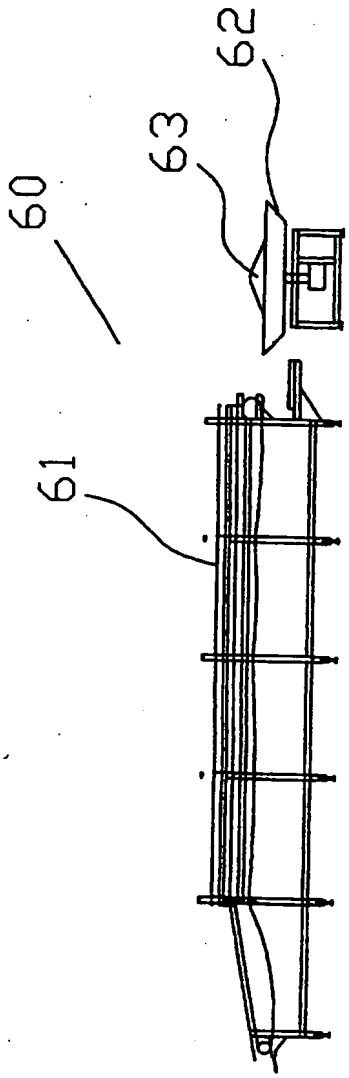

Fig. 17

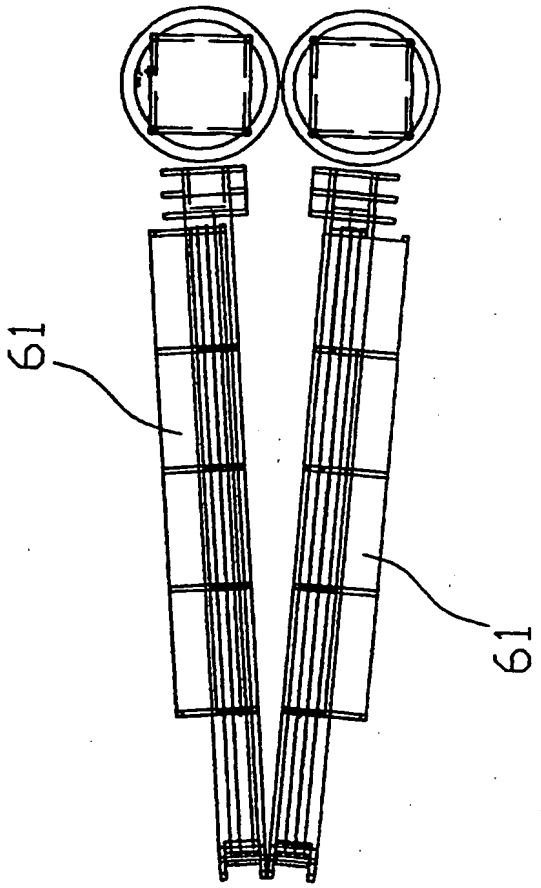

Fig. 16

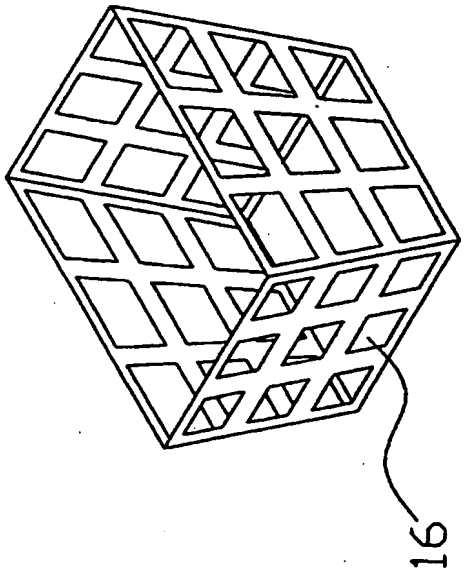

Fig. 19

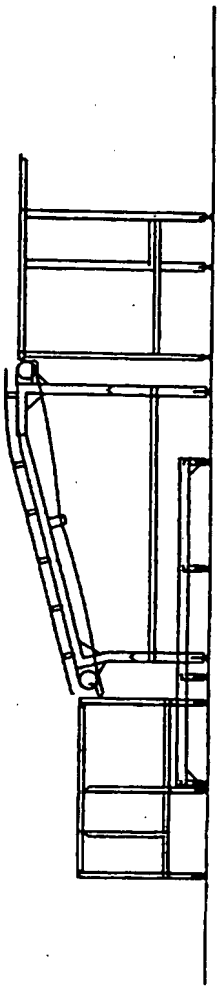

Fig. 18

"Crab Processing"

Introduction

The present invention relates to a method for processing crab.

There are problems associated with the known methods of processing of crabs. If crabs are cooked in large vats, 70-80% of the product is overcooked while only some of them are correctly cooked. This is done to ensure that all of the crabs are cooked sufficiently and thus, there is overcooking of much of the product. Further, overcooking leads to a lesser yield and in general, there is an inconsistency in the product. A further problem with cooking of crabs is to ensure that the water is at the correct salinity since, if not, the salt will leech out resulting in a dry crab meat. A further problem is assuring that there is no microbiological degradation of the crab meat. Deterioration takes place rapidly and bacteria multiplies rapidly in dead shellfish. It is essential to provide an environment in which there is minimum microbiological growth.

A further problem arises in that usually where crabs are cooked in large batches, they are also either killed in the cooking vat or are killed separately in large batches. This again leads to product degradation and increased microbiological counts. Essentially, what is required is to provide a method for processing crabs such that the crabs are correctly killed and cooked and the meat is succulent and moist with minimal loss of salt or water and that there is sufficient control of the operation to keep microbiological counts to a minimum.

Statements of Invention

According to the invention there is a method for processing crab comprising:-

placing crabs in deoxygenated fresh water and citric acid solution at a temperature in the range of 27 to 33°C for approximately 30 minutes and rinsing the crabs in citric acid;

stacking a number of crabs in a maximum of six superimposed layers of crabs in an open packing container having perforated side walls such that the crabs form voids therebetween;

cooking the crabs for at least 20 minutes by conveying the crabs in the packing containers through a brine and citric acid solution having a temperature of at least 98°C, the conveying motion being such as to agitate the solution and ensure circulation of solution through the containers and around the crabs;

cooling the crabs by conveying the crabs in the packing containers through a cooling solution of chilled brine and citric acid, such that the core temperature of the crab is reduced to at least 25°C, the motion of the conveying causing agitation of the cooling solution for circulation through the packing containers and around the crabs;

removing inedible crab meat; and

grading, packing, pasteurising and storing the crabs.

In another embodiment of the invention the crab is graded into whole crab for packing or for further processing

either for meat extraction or provision of whole crab claws and in which the whole crabs are vacuum packed into an envelope of a flexible material containing brine such that the envelope is tightly drawn around the crabs. The crabs can be in layers of 3 to 4 crabs.

In a further embodiment of the invention the citric acid is in a concentration range of 0.5 to 2.5% and the brine solution is a 1 to 3% sodium chloride solution.

In a still further embodiment of the invention the crabs are cooked at a temperature in the range of 98 to 100°C, preferably 99 ± 0.2°C. The crabs may be cooked for between 20 to 30 minutes, preferably 24 to 26 minutes.

In another embodiment of the invention the pH of the brine is maintained below a pH of 5 to inhibit bacterial growth and the microbiological levels are assessed daily as follows:-

total viable count at 37°C;

total viable count at 22°C;

E. coli at 44°C;

P. coli at 37°C;

Staph Aur at 37°C; and

Faecal Strep at 37°C

to ensure the absence of bacterial growth.

In a further embodiment of the invention the crabs are placed in deoxygenated fresh water at a temperature of 30 ± 0.2°C.

In another embodiment of the invention the envelope is a 170 microns, PA-PE tubular bottom weld bags laminated and heat resistant to a 190°C and the brine solution placed in the bags is 14% sodium chloride.

In a further embodiment of the invention the crabs are pasteurised by heating to a temperature in the range of 80 to 100°C, preferably 90 ± 2°, for 90 ± 5 minutes. The pasteurised crabs are cooled to at least 25°C.

In a still further embodiment of the invention after pasteurising, crab is super chilled until the temperature reaches a range of 0-1°C and in which the crab is stored in a chilled container maintained between 0 and 4°C.

Detailed Description of the Invention

The invention will be more clearly understood from the following description of the process and a plant for carrying out the process according to the invention in which:-

Fig. 1 is a plan view of the plant shown in situ in a building;

Fig. 2 is a plan view of most of the plant;

Fig. 3 is a front elevation in the direction of the arrow A in Fig. 2;

Fig. 4 is a further front elevation in the direction of the arrow B of Fig. 2;

Fig. 5 is an elevation in the direction of the arrow C of Fig. 2;

Fig. 6 is an enlarged plan view of portion of the plant;

Fig. 7 is an elevation of the portion of the plant illustrated in Fig. 6;

Fig. 8 is an enlarged plan view of another portion of the plant;

Fig. 9 is an elevation of the portion of the plant illustrated in Fig. 8;

Fig. 10 is a still further enlarged plan view of portion of the plant;

Fig. 11 is an elevation of the portion of the plant illustrated in Fig. 10;

Fig. 12 is a further enlarged plan view of portion of the plant;

Fig. 13 is an elevation of the portion of the plant illustrated in Fig. 12;

Fig. 14 is an enlarged plan view of another portion of the plant;

Fig. 15 is an elevation of the portion of the plant illustrated in Fig. 14;

Fig. 16 is a further enlarged plan view of portion of the plant;

Fig. 17 is an elevation of the portion of the plant illustrated in Fig. 16;

Fig. 18 is an enlarged end view of the plant similar to Fig. 5; and

Fig. 19 is a perspective view of a crate used for packing crab.

Referring to the drawings and initially to Fig. 1, there is provided an intake area 1, an initial processing area 2, a cooking section 3, a cooling section 4, a cleaning/washing section 5, a packing section 6, a pasteurising section 7 and a chill and store area 8.

Referring now specifically to Figs. 2 to 5 inclusive, it will be seen from Figs. 2 to 5 that the essential plant contained in the initial processing area 2, the cooking section 3, the cooling section 4, the cleaning and washing section 5 and the packing section 6 comprise a series of various conveyors feeding various equipment so that there is essentially a continuous flow of product on these conveyors through these various areas and sections.

Referring now to Figs. 6 and 7, there is illustrated the initial processing equipment indicated generally by the reference numeral 10 which is in the initial processing area 2 which comprises a tank 11 in which is mounted a conveyor 12 having an intake hopper 13 and an output chute 14 feeding a table 15 on which is mounted containers 16 which are illustrated in more detail in Fig. 19. Each container 16 is essentially a container of plastics material having a plurality of holes therein into which crab can be packed.

The tank 11 incorporates heating coils, liquid inlets, drainpipes and other ancillary control equipment as is necessary. The table 15 incorporates a plurality of rollers 17. An intermediate storage unit 18 is provided.

Referring now to Figs. 8 and 9, there is illustrated a cooking unit indicated generally by the reference numeral 20 in the cooking section 3. The cooking unit 20 comprises a tank 21 having an inlet hopper 22 for containers 16 and an outlet 23 for a conveyor 24 which feeds directly to the cooling section 4. Again, the tank 21 has water inlets and outlets, heating coils, agitation equipment, and general process control equipment.

Referring now to Figs. 10 and 11, there is illustrated in the cooling section 4 a cooling unit indicated generally by the reference numeral 30. The cooling unit 30 again comprises a tank 31 in which is mounted a conveyor 32 having an inlet 33 fed directly from the outlet 23 of the cooking unit 20. The conveyor 32 feeds at an outlet 34, a transfer platform 35. The tank 31 has the usual liquid inlets and outlets and control equipment as well as both heating and cooling coils, again not shown.

Referring now to Figs. 12 and 13, there is illustrated portion of a cleaning and washing unit, indicated generally by the reference numeral 40. The cleaning and washing unit 40 is in the cleaning/washing section 5 and comprises a framework 41 above which is mounted a table 42 incorporating rollers. Within the framework 41, there is mounted an upper conveyor 43 and a lower conveyor 44. The upper conveyor 43 is divided into four separate sections by means of five longitudinally arranged upstanding divider walls 45. There are effectively then two inner conveyor sections and two outer conveyor sections. The two outermost sections of the conveyor 43

are used for crab claws and the two inner sections for whole crab.

Five work stations are provided on each side of the framework 41 by tables 46 and associated chutes 47. One of the chutes 47 feeds the lower conveyor 44 and the other chute 47 feeds a waste bin.

Referring to Figs. 14 and 15, the remainder of the cleaning and washing unit 40 is illustrated and comprises a washing tank 50 housing a transfer conveyor 51, again divided into four separate sections and fed directly from the upper conveyor 43 at its inlet 53. The conveyor 51 has an outlet portion 54 across the two outer portions of which are mounted diverter plates (not shown) to divert product off the two outer portions of the conveyor 51 into storage containers for crab claws. The two extractor hoods 56 and 57 above washer jets (not shown) define therebetween a further work station 58.

Referring now to Figs. 16 and 17, there is illustrated a packing unit indicated generally by the reference numeral 60 in the packing section 6. The packing unit 60 comprises a pair of split conveyors 61, each fed from the central portions of the conveyor 51. Each split conveyor 61 in turn faces a pair of rotary tables of the "lazy susan" type, above each of which is mounted a vacuum packer 63.

In operation, crab is first stored live in the intake area 1 and are then transferred into the initial processing area 2 where they are placed in the intake hopper 13. The tank 11 is provided with preheated water at 30° $\pm$1°C. The water is deoxygenated fresh water and approximately 2% citric acid solution is added. Because the crab is added gradually to the intake hopper 13, there is no large batch

of crab entering the water at any particular time. The conveyor 12 operates so that the crab is delivered from the intake hopper 13 to the delivery chute 14 after about 30 minutes. The citric acid solution assists in the rinsing of the crab. At the delivery chute 14, the crab which are now dead or almost completely stunned, are placed in the containers 16. Generally, about three rows of crab are placed one on top of the other forming voids therebetween and since there are holes in the sides of the container, there is room for water to flow in and out. The containers 16 are then brought to the cooking section 3 where they are placed in the inlet 22 of the cooking unit 20. The tank 21 contains a 3% brine solution and the temperature is kept at 99° ± 1°. The cooking time is approximately 25 minutes. It will be appreciated that the movement of the conveyor 24 through the cooking unit 20 will cause agitation of the water and cause an even flow around the crabs to ensure consistent and even cooking.

The crab is delivered straight out of the cooking unit 20 directly into the cooling unit 30, the tank of which contains 2½% to 3% brine. The purpose of the cooling unit is to reduce the temperature of the crab from the cooking temperature, namely, approximately 98 to 99°C to 25°C within 15 minutes. A similar amount of citric acid is also provided in the water to ensure that the pH levels are controlled.

The cooked and cooled crab is then delivered out the outlet 34 onto the transfer platform 35 where the containers are delivered by the conveyor 47 to the cleaning and washing unit 40.

During the cooking and cooling operations, the containers 16 may be stacked two or three high, when they are taken off the transfer platform 35, they are placed singly on

the conveyor 47 which delivers them to the table 42. Operatives at each work station remove a container 16 and carry out an initial inspection. The operative first examines the crab and cleans out the inedible portions of the crab meat and decides whether the crab can be sold whole or not. If the crab is for sale whole, it is placed on one of two of the inner portions of the upper conveyor 43, depending on its quality. Crab that cannot be sold whole has the crab claws removed which are placed on the two outer portions of the upper conveyor 43, depending on which is closest to the operative. The remainder of the crab from which the claws have been removed which is still suitable for sale as meat, is then delivered down one of the chutes 47 to the lower conveyor 44. Thus, after removal of inedible meat, the crab has been divided into four different grades, namely, whole crabs of one grade, whole crabs of another grade, crab claws and crabs for meat extraction. The whole crabs and the crab claws are then delivered out from the upper conveyor 43 to the conveyor 51 and they are first washed under the extraction hood 56.

When the crab has received it's first washing, it is transported through the washing tank 50 by the conveyor 51 to the work station 58 where the crab is visually inspected for cleanliness and any additional cleaning is carried out and the crab is turned over so that the other side of the crab is exposed to the washing jets beneath the next extraction hood 57 and the washed crab is then delivered out the conveyor 51 to the two conveyors 61 while the crab claws are removed for subsequent packing.

Usually the crabs from which the claws have been removed have been damaged in some way and are used for meat extraction, either brown meat or white meat, depending on the situation. The whole crab is delivered to the split

conveyors 61 where usually the superior grade is refined, wrapped in parchment and placed in a pouch of plastics material. Before final sealing, brine is added and the pack is then vacuum packed. In certain circumstances, the other grade of crab may be simply pouched with brine and vacuum packed.

The crab claws, after having been washed, may be provided with a glazing before being vacuum packed and treated in the same manner as the first grading. The third grading is the damaged crabs which are then sorted for crab meat extraction, depending on the type of meat being extracted, for example, brown meat which may be minced or may be left un-minced and then may be packed and frozen in much the same manner as heretofore or may be separated into white meat, again for extraction and packing.

After vacuum packing, the product is delivered to conventional pasteurising equipment in the pasteurising section 7 but may also be pasteurised in the cooking unit 20. Pasteurisation takes place at 90°C ± 2° for 90 minutes ± 5 minutes to achieve good bacterial kill. The crabs are then submerged in chilled water for about 8 to 10°C for 30 minutes until the core of the crab is below 30°C. They then can be frozen and super-chilled in a conventional manner until the temperature is at 0°C ± 1°. The final crabs are packed and ready for dispatch at a maintained chilled storage of between 0° and +4°C until delivery.

Essentially, the process uses all the meat. Various tests on the crab are carried out during the production process. For example, after cooking, tests are carried out to ensure that there is no detection of Faecal Strep, Staph Aur, P. coli and E. coli. Subsequently, during vacuum packing, sufficient samples are taken to ensure that there is no detection of Faecal Strep, Staph Aur, P. coli, E.

coli and that further, the TVC count is less than 10,000.

While in the embodiment described above, it has been stated that the movement of the conveyor through the various tanks will allow sufficient agitation, it is envisaged that additional agitation of the water may be provided whether it be cooking water or washing water and that further, the agitation may be provided by some form of stirrers or indeed by overpumping of the water.

The invention is not limited to the embodiments hereinbefore described which may be varied in detail.

CLAIMS

1. A method for processing crab comprising:-

placing crabs in deoxygenated fresh water and citric acid solution at a temperature in the range of 27 to 33°C for approximately 30 minutes and rinsing the crabs in citric acid;

stacking a number of crabs in a maximum of six superimposed layers of crabs in an open packing container having perforated side walls such that the crabs form voids therebetween;

cooking the crabs for at least 20 minutes by conveying the crabs in the packing containers through a brine and citric acid solution having a temperature of at least 98°C, the conveying motion being such as to agitate the solution and ensure circulation of solution through the containers and around the crabs;

cooling the crabs by conveying the crabs in the packing containers through a cooling solution of chilled brine and citric acid, such that the core temperature of the crab is reduced to at least 25°C, the motion of the conveying causing agitation of the cooling solution for circulation through the packing containers and around the crabs;

removing inedible crab meat; and

grading, packing, pasteurising and storing the crabs.

2. A method as claimed in claim 1 in which the crab is graded into whole crab for packing or for further processing either for meat extraction or provision of whole crab claws and in which the whole crabs are vacuum packed into an envelope of a flexible material containing brine such that the envelope is tightly drawn around the crabs.

3. A method as claimed in claim 1 or 2, in which the crabs are in layers of 3 to 4 crabs.

4. A method as claimed in any preceding claim, in which the citric acid is in a concentration range of 0.5 to 2.5%.

5. A method as claimed in any preceding claim, in which the brine solution is a 1 to 3% sodium chloride solution.

6. A method as claimed in any preceding claim, in which the crabs are cooked at a temperature in the range of 98 to 100°C.

7. A method as claimed in any preceding claim, wherein the crabs are cooked at a temperature of 99 $\pm$ 0.2°C.

8. A method as claimed in any preceding claim, wherein the crabs are cooked for between 20 to 30 minutes.

9. A method as claimed in any preceding claim, wherein the crabs are cooked for 24 to 26 minutes.

10. A method as claimed in any preceding claim, wherein the pH of the brine is maintained below a pH of 5 to inhibit bacterial growth.

11. A method as claimed in any preceding claim, wherein microbiological levels are assessed daily as follows:-

total viable count at 37°C;

total viable count at 22°C;

E. coli at 44°C;

P. coli at 37°C;

Staph Aur at 37°C; and

Faecal Strep at 37°C

to ensure the absence of bacterial growth.

12. A method as claimed in any preceding claim, in which the crabs are placed in deoxygenated fresh water at a temperature of 30 ± 0.2°C.

13. A method as claimed in claim 2 and any of claims 3 to 12, wherein the envelope is a 170 microns, PA-PE tubular bottom weld bags laminated and heat resistant to a 190°C.

14. A method as claimed in claim 2 and any of claims 3 to 13, in which the brine solution placed in the bags is 14% sodium chloride.

15. A method as claimed in any preceding claim, in which the crabs are pasteurised by heating to a temperature in the range of 80 to 100°C.

16. A method as claimed in any preceding claim, in which the crabs are pasteurised by heating to a temperature of 90 ± 2°.

17. A method as claimed in any preceding claim, in which the crabs are pasteurised for 90 ± 5 minutes.

18. A method as claimed in any preceding claim, in which the pasteurised crabs are cooled to at least 25°C.

19. A method as claimed in any preceding claim in which, after pasteurising, crab is super chilled until the temperature reaches a range of 0-1°C and in which the crab is stored in a chilled container maintained between 0 and 4°C.

20. A method for processing crabs substantially as described herein.

21. Crab processed in accordance with the method as claimed in any preceding claim.

The Patent Office

— 17

Application No: GB 9817215.8
Claims searched: 1-21

Examiner: Keith Kennett
Date of search: 27 October 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): A2B (BMM39); A2U (U1C, U1S)

Int Cl (Ed.6): A22C 29/00, 29/02; A23L 1/33, 1/333

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
A	US 4336274 (ROSS) see the Figure	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.